Ultrafast switching of photonic band gap crystals

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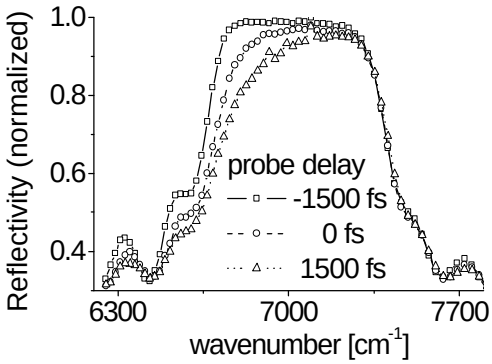
We use free carrier generation by ultrafast laser pulses to switch the optical properties of semiconductor photonic crystals, in particular the optical density of states. We set important requirements for the switching magnitude, the time-scale, the induced absorption as well as the spatial homogeneity. From a new nonlinear absorption model that incorporates scattering, we conclude that density of states switching is feasible for pump wavelengths near the two-photon absorption edge of the semiconductor.[1] Here we present experiments that demonstrate a large and ultrafast change in the reflectivity of a GaAs/AlAs photonic structure induced by two photon absorption (see figure), in excellent agreement with theory.



Ultrafast switching of a large GaAs/AlAs structure (25 pairs of layers) showing a large shift of the stopgap.

[1] T.G. Euser and W.L. Vos, *J. Appl. Phys.* **97**, 043102 (2005)